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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/783,149	02/15/2001	Yang-Iim Choi	Q61835	1522

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EXAMINER	
EHICHIOYA, FRED I	

ART UNIT	PAPER NUMBER
2172	

DATE MAILED: 04/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/783,149	CHOI ET AL.	
	Examiner	Art Unit	
	Fred I. Ehichioya	2172	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 4 - 9* is/are rejected.

7)☒ Claim(s) *3* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicants' arguments, with respect to claims 1 – 9 filed January 28, 2004 have been fully considered but they are not persuasive for the reasons set forth herein below.

Applicants argue: "even if the teachings of Ganapathy and Barbara are combined, it does not suggest performing a similarity measurement and then applying search conditions limited by the search results, followed by performing a changed similarity measurement" (page 4; par. 3).

Examiner respectfully disagrees with all of the allegations as argued. Examiner, in his previous office action, gave detail explanation of claimed limitation and pointed out exact locations in the cited prior art.

Regarding applicants' argument: Ganapathy teaches performing a changed similarity measurement on the given query vector (column 16, line 66 through column 17, line 2 – 35, "Fig.1 also shows similarity measurement"). Ganapathy discloses applying search conditions (column 17, lines 45 – 67 and column 18, lines 1 – 20; the rules are the search conditions). It is apparent that Ganapathy teaches performing a changed similarity measurement (see column 16, line 66 through column 17, line 5, similarity measure is performed on different changed pattern).

2. In view of the above, the examiner contends that all limitations as recited in the claims have been addressed in this Action. For the above reasons, Examiner believed that rejection of the last Office action was proper.

Claim objections

3. Claim 3 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,411,953 issued to Ganapathy et al. (hereinafter "Ganapathy").

Regarding claim 1, Ganapathy teaches a method for adaptively searching a feature vector space, the method comprising the steps of:

(a) performing a similarity measurement ("performs similarity measurements", column 16, line 67 – column 17, line 1) on a given query vector ("query vector", column 11, line 1), within the feature vector space ("feature vector", column 18, line 14); and

(b) applying search conditions (column 17, line45 thru column 18, line 20, "The similarity measurement component 14 finds similar patterns using the rules from the grammar G. The similarity measurement component 14 accesses an image database 30, and includes a similarity judging block 32. Given an input image A, which may be submitted or selected as part of a user query Q, for a designated set of the images in the database 30, rules R.sub.1 through R.sub.4 are applied and corresponding distance measures are computed", column 8, lines 59 – 67) limited by the result ("a set of best matches is found", column 9, line 2) of the similarity measurement ("similarity measurement component 14", column 8, line 61) obtained in the step (a) and performing a changed similarity measurement on the given query vector (see column 11, lines 2 – 35; column 12, lines 21 – 26; column 15, lines 14 – 55; column 16, lines 66 – 57 and column 17, lines 1 – 5).

Ganapathy does not specifically teach the claim limitations "performing a changed similarity measurement on the given query vector"; but referring to the following cited

columns and lines (column 8, lines 59 – 67, column 11, lines 2 – 35; column 12, lines 21 – 26; column 15, lines 14 – 55; column 16, lines 66 – 57 and column 17, lines 1 – 5), it is apparent that Ganapathy suggest performing a changed similarity measurement. It would have been obvious to one of ordinary skill in the art that "the formulation of a query vector to search for a lighter color" and "the same pattern at different scales will have similar feature vectors" provide a clear suggestion of performing a changed similarity measurement. "The similarity between A and B is measured in terms of that color using the minimum of distance measures between the color element" (column 12, lines 44 – 46). The motivation is that even if the difference between the two area percentages is very large, the overall distance yields a measure that does not match human perception. This makes the search easy and efficient.

6. Claim 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ganapathy in view of U.S. Patent 5,710,916 issued to Barbara et al (hereinafter "Barbara").

Regarding claim 2, Ganapathy teaches (b) the steps of:

(b-1) obtaining a plurality of candidate approximation regions ("see column 11, lines 51 - 55)

Ganapathy does not explicitly teach performing an approximation level filtering according to a distance measurement limited by the result of the similarity measurement obtained in the step (a); and

(b-2) performing a data level filtering on said plurality of obtained candidate approximation regions.

Barbara teaches claimed performing an approximation level filtering according to a distance measurement limited ("A small number of elements that are at a greater distance than d may also be picked up when querying an FQ tree. These are filtered out by further processing", column 16, lines 46 – 48) by the result of the similarity measurement obtained in the step (a); and

(b-2) performing a data level filtering ("Although the search times for larger databases keep growing linearly with the database size, FQ-trees provide a significant reduction of search time with respect to sequential search. In this sense, FQ-trees act more like filters than indices, pruning a constant fraction of the database", column 17, lines 38 - 42) on said plurality of obtained candidate approximation regions.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified teaching of Ganapathy combine with the teaching of Barbara wherein performing a data level filtering according to a distance enables strings that do not match the input strings to be filtered out. This optimizes the query processing and allowing the desired data to be retrieved.

Regarding claim 3, Ganapathy teaches (a) the steps of:

(a-1) obtaining a predetermined number of nearest candidate approximation regions by measuring a first plurality of distances ("generates a distance measure characterizing the relationship of the selected image to another image stored in a database, by

applying a grammar, comprising a set of predetermined rules, to the color and texture information extracted from the selected image and corresponding color and texture information associated with the stored image", column 2, lines 52 – 55) between the query vector ("query vector", column 12, line2) and each said candidate approximation region ("invention utilizes color features and associated distance measures comprising the subset of colors which best represent an image, augmented by the area percentage in which each of these colors occur", column 11, lines 46 – 47); and

(a-2) obtaining a plurality of K nearest neighbor ("Some of the simplest methods use a nearest neighbor technique, where the first two objects combined are those that have the smallest distance between them. Another commonly used technique is the furthest neighbor technique where the distance between two clusters is obtained as the distance between their furthest points", column 4, line 39 - 44) feature vectors ("feature vectors", column 12, line 3) by measuring a second plurality of distances between ("similarity between A and B is measured", column 12, lines 44 – 46) a plurality of feature vectors ("feature vectors", column 12, line 3) in said nearest candidate approximation regions ("The remaining pixels were represented with their closest matches (in an L.sup.2 sense) from the extracted dominant colors", column 12, lines 1 – 2; Colors in this case is translated to be the image areas or regions) and the query vector ("query vector", column 11, line 2), where K is a positive integer.

7. Claim 4 - 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ganapathy and Barbara and further in view of U.S. Patent 6,122,628 issued to Castelli et al. (hereafter "Castelli").

Regarding claim 4, Ganapathy and Barbara does not explicitly teach step (b-1) the steps of: (b-1-1) calculating a K'-th shortest distance for said plurality of K nearest neighbor feature vectors obtained by said second plurality of distance measurements according to a changed distance measurement where K' is a positive integer, and setting a calculated distance as r^{u}_{t+1}; and

(b-1-2) calculating K'-th smallest lower bound limit for said plurality of predetermined number of nearest candidate approximation regions obtained by said first plurality of distance measurements according to said changed distance measurement and set as $\emptyset^{u}_{t+1}$ as claimed.

Castelli teaches steps of:

(b-1-1) calculating a K'-th shortest distance ("elements that are closer to the specific data", column 4, lines 57 – 57) for said plurality of K nearest neighbor ("K nearest neighbors", column 4, lines 60 – 61) feature vectors obtained ("feature vectors extracted", column 7, line 3) by said second plurality of distance measurements ("distance measure", column 7, line 60) according to a changed distance measurement ("dimensions where the individual elements in the vector are different", column 8, lines 19 – 20) where K' is a positive integer ("let k be the desired number", column 11, line 59), and setting a calculated distance as r^{u}_{t+1} ("FIG. 3 shows an example of a distance

computation in the original space and a projected subspace where the projection preserves the relative distance between any two of the three points", column 8, lines 26 – 29); and

(b-1-2) calculating K'-th smallest ("the dimension corresponding to the smallest eigenvalue", column 12, line 25 - 25) lower bound limit for said plurality ("a requester specifies the desired precision of the search and a lower bound", column 12, lines 19 – 20) of predetermined number of nearest candidate approximation regions ("a total of three dimensions are required to represent the entire space", column 8, lines 4 – 5) obtained by said first plurality of distance measurements ("distance measure", column 7, line 60) according to said changed distance measurement ("dimension where the individual elements in the vector are different", column 8, lines 19 – 20) and set as $\varnothing^{u}_{t+1}$.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified teaching of Ganapathy and Barbara combine with the teaching of Castelli wherein calculating a K'-th shortest distance of K nearest neighbor enables for assessing if other clusters can contain elements that are closer to the specific data than the farthest of the most similar element retrieved. Clustering information can be used to reconstruct boundaries of the partitions, and these boundaries can be used to determine if a cluster can contain one of k nearest neighbors.

Regarding claim 5, Castelli teaches step (b-1) further comprises the steps of:

(b-1-3a) measuring a distance $L_i(W_{t+1})$ ("distance measure", column 7, line 60) between said lower bound limit ("a lower bound", column 12, line 20) of at least one said nearest candidate approximation region ("original space and a projected subspace", column 8, line27) and said query vector to determine a first new distance measurement ("distance measure", column 7, line 60), wherein N is a positive integer denoting the number of objects ("N elements", column 11, line 60) in the feature vector space ("feature vectors", column 7, line 3) and i is a variable ranging from 1 to N ("Let k be the desired number of nearest neighbors to a template in a database of N elements. Here, since the operation is approximate, a user typically requests a number of returned results greater than k. Let n be the number of returned results; of the n results, only c will be correct, in the sense that they are among the k nearest neighbors to the template", column 11, lines 62 – 65);

(b-1-4) comparing the distance $L_i(W_{t+1})$ ("compares..." column 16, line 61 – 63)) obtained in the step (b-1-3a) with a minimum value ("smallest number", column 11, line 49) min (Φ, r^u_{t+1}, $\varnothing^u_{t+1}$) of K-th smallest upper bound limit Φ, r^u_{t+1} and $\varnothing^u_{t+1}$ wherein

(b-1-5) if the distance $L_i(W_{t+1})$ ("distance computation", column 8, line 26) is less than or equal to the minimum value ("smallest number", column 11, line 49) min (Φ, r^u_{t+1}, $\varnothing^u_{t+1}$) setting a corresponding approximation region ("a requester specifies the desired precision of the search and a lower bound on the allowed recall", column 12, lines 19 – 20) as a new candidate approximation reunion; and

(b-1-6) if the distance $L_i(W_{t+1})$ ("distance", column 8, line 26) is greater than the minimum value ("smallest number", column 11, line 49) min (Φ, r^u_{t+1}, $\varnothing^u_{t+1}$) excluding the corresponding approximation region ("The precision is the proportion of the returned results that are correct", column 11, lines 65 – 66).

Regarding claim 6, Castelli teaches the step (b-1) further comprises the steps of:

(b-1-3b) measuring a distance $U_i(W_{t+1})$ between the upper bound limit of at least one said

nearest candidate approximation region and the query vector for a second new distance measurement ("the distance between the selected example vector and each of the centroids of the clusters is computed using the distance metric (1311)', column 17, lines 40 – 43), assuming that N is a positive integer denoting the number of objects in the ("Let k be the desired number of nearest neighbors to a temple in database of N elements", column 11, lines 59 – 60)

feature vector ("feature vector", column 7, line 3) space and i is a variable ranging from 1 to N ("Let n be the number of returned results; of the n results, only c will be correct, in the sense that they are among the k nearest neighbors to the template", column 11, lines 62 – 65);

(b-1-7) updating the K-th smallest upper bound limit Φ based on the distance $U_i(W_{t+1})$ ("If the k-nearest neighbor set (1009) is not empty at the beginning of step 1007, then the intra-cluster search logic, in step 1007 updates the k-nearest neighbor set when an element is found whose mismatch index .delta..sup.2 is smaller than the

largest of the indexes currently associated with elements in the k-nearest neighbor set (1009). The k-nearest neighbor set can be updated by removing the element with largest mismatch index .delta..sup.2 from the k-nearest neighbor set (1009) and substituting the newly found element for it", column 15, lines 11 – 19).

Regarding claim 7, Castelli teaches the steps of (b-1-1) - (b-1-6) are repeated until the approximation level filtering is performed on all said candidate approximation regions in a database ("the dimensionality reduction logic derives a maximum value of precision n_{max} for which the desired recall is attained. Then the dimensionality reduction logic iterates the same procedure by removing the dimension corresponding to the next smallest eigenvalue, and computes the corresponding precision for which the desired recall is attained", column 12, lines 28 – 34), wherein all the candidate approximation regions in said database is denoted by a positive integer (N), which represents a number of objects in said database ("Let k be the desired number of nearest neighbors to a temple in database of N elements", column 11, lines 59 – 60).

Regarding claim 8, Castelli teaches the steps of (b-1-1)-(b-1-6) are repeated until the approximation level filtering is performed on all said candidate approximation regions in

a database ("The iterative procedure is terminated when the computed precision is below the threshold value specified by the user, and the dimensionality reduction logic retains only the dimensions retained at the iteration immediately preceding the one

where the termination condition occurs", column 12, lines 34 – 39), wherein all the candidate approximation regions in said database is denoted by a positive integer (N), which represents a number of objects in said database ("Let k be the desired number of nearest neighbors to a temple in database of N elements", column 11, lines 59 – 60).

Regarding claim 9, Ganapathy and Barbara does not explicitly teach the step (b-2) comprises the steps of:

(b-2-1) performing a third distance measurement between each of all feature vectors in said plurality of nearest candidate approximation regions and the query vector; and (b-2-2) determining K' nearest neighbor feature vectors as retrieved vectors depending on the result of said third distance measurements performed in the step (b-2-1) as claimed.

Castelli teaches claimed steps of:

(b-2-1) performing a third distance measurement between each of all feature vectors in said plurality of nearest candidate approximation regions ("The term d.sub.1 is the Euclidean distance between the projection (504) of the template onto Subspace 1, called Projection 1, and the projection V' (507) of V (506) onto Subspace 1; the term d.sub.2 is the distance between the template T (501) and Projection 1 (504), its projection onto Subspace 1; in other words, d.sub.2 is the distance between the template T (501) and Subspace 1. The approximation introduced can now be bound by substituting equation (7) for equation (6) in the calculation of the distance between the

template T (501) and the vector V (506)", column 9, lines 45 - 55) and the query vector; and

(b-2-2) determining K' nearest neighbor ("determine if a cluster can contain one of the k nearest neighbors", column 4, lines 60 - 61) feature vectors as retrieved vectors ("Nearest neighbor queries: where the most "similar" vectors are retrieved based on a similarity measure", column 7, lines 57 - 58) depending on the result of said third distance measurements performed in the step (b-2-1) ("a total of three dimensions are required to represent the entire space", column 9, lines 4 - 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified teaching of Ganapathy and Barbara combine with the teaching of Castelli wherein calculating a K'-th shortest distance of K nearest neighbor enables for assessing if other clusters can contain elements that are closer to the specific data than the farthest of the most similar element retrieved. Clustering information can be used to reconstruct boundaries of the partitions, and these boundaries can be used to determine if a cluster can contain one of k nearest neighbors.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred I. Ehichioya whose telephone number is 703-305-8039. The examiner can normally be reached on M - F 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E. Breene can be reached on 703-305-9790. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Fred I. Ehichioya
Examiner
Art Unit 2172
March 26, 2004

SHAHID ALAM
PRIMARY EXAMINER